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Doc. Number:

☐ Tentative Specification
■ Preliminary Specification
☐ Approval Specification

MODEL NO.: N140BGE
SUFFIX: L31

Customer: Lenovo International

APPROVED BY **SIGNATURE**

Name / Title
Note

Please return 1 copy for your confirmation with your signature and comments.

Approved By	Checked By	Prepared By
楊竣傑 **2010-12-20 09:13:14 CST**	陳逸銘 **2010-11-25 18:15:51 CST**	陳郁甫 **2010-11-23 16:48:13 CST**

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CONTENTS

1. GENERAL DESCRIPTION 4
1.1 OVERVIEW 4
1.2 GENERAL SPECIFICATI0NS 4
2. MECHANICAL SPECIFICATIONS 4
2.1 CONNECTOR TYPE 4
3. ABSOLUTE MAXIMUM RATINGS 5
3.1 ABSOLUTE RATINGS OF ENVIRONMENT 5
3.2 ELECTRICAL ABSOLUTE RATINGS 5
3.2.1 TFT LCD MODULE 5
4. ELECTRICAL SPECIFICATIONS 6
4.1 FUNCTION BLOCK DIAGRAM 6
4.2. INTERFACE CONNECTIONS 6
4.3 ELECTRICAL CHARACTERISTICS 8
4.3.1 LCD ELETRONICS SPECIFICATION 8
4.3.3 BACKLIGHT UNIT 13
4.4 LVDS INPUT SIGNAL TIMING SPECIFICATIONS 14
4.4.1 LVDS DC SPECIFICATIONS 14
4.4.2 LVDS DATA FORMAT 14
4.4.3 COLOR DATA INPUT ASSIGNMENT 15
4.5 DISPLAY TIMING SPECIFICATIONS 16
4.6 POWER ON/OFF SEQUENCE 18
5. OPTICAL CHARACTERISTICS 19
5.1 TEST CONDITIONS 19
5.2 OPTICAL SPECIFICATIONS 19
6. RELIABILITY TEST ITEM 23
7. PACKING 24
7.1 MODULE LABEL 24
7.2 CARTON 25
7.3 PALLET 26
8. PRECAUTIONS 27
8.1 HANDLING PRECAUTIONS 27
8.2 STORAGE PRECAUTIONS 27
8.3 OPERATION PRECAUTIONS 27
Appendix. EDID DATA STRUCTURE 28
Appendix. OUTLINE DRAWING 31
Appendix. LCD MODULE INSPECTION SPECIFICATION 32

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REVISION HISTORY

Version	Date	Page	Description
0.0	Aug. 25, 2010	All	Spec Ver.0.0 was first issued for Lenovo International
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1. GENERAL DESCRIPTION

1.1 OVERVIEW

N140BGE-L31 is a 14.0" (14.0" diagonal) TFT Liquid Crystal Display module with LED Backlight unit and 40 pins LVDS interface. This module supports 1366 x 768 HD mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction.

1.2 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Screen Size	14.0" diagonal		
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1366 x R.G.B. x 768	pixel	-
Pixel Pitch	0.2265 (H) x 0.2265 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (3H), Anti-Glare	-	-
Luminance, White	200	Cd/m2	
Power Consumption	Total 4 W (Max.) @ cell 1 W (Max.), BL 3 W (Max.)		(1)

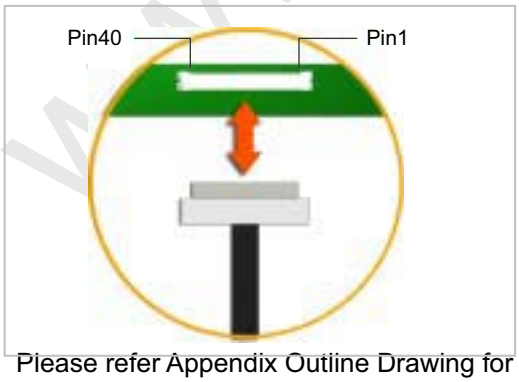
Note (1) The specified power consumption (with converter efficiency) is under the conditions at VCCS = 3.3 V, fv = 60 Hz, LED_VCCS = Typ, fPWM = 200 Hz, Duty=100% and Ta = 25 ± 2 ºC, whereas mosaic pattern is displayed.

2. MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	319.9	320.4	320.9	mm	(1)
	Vertical (V)	198.1	198.6	199.1	mm	
	Thickness (T)	-	-	3.6	mm	
Active Area	Horizontal	309.099	309.399	309.699	mm	
	Vertical	173.652	173.952	174.252	mm	
Weight		-	310	320	g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

2.1 CONNECTOR TYPE



Please refer Appendix Outline Drawing for detail design.

Connector Part No.: IPEX-20455-040E-12 / Foxconn GS13401-1110S-7H

User's connector Part No: IPEX-20453-040T-01

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3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

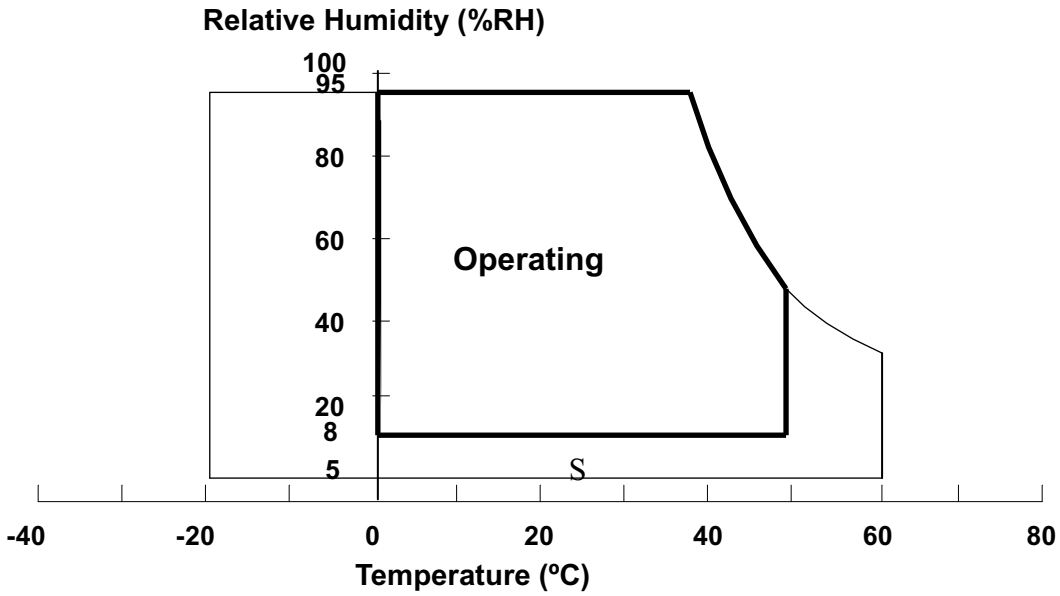
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1),(2)
Operating Ambient Temperature	T_{OP}	0	+50	ºC	(1)

Note (1) (a) 90 %RH Max. (Ta <= 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.

Note (2) The temperature of panel surface should be -20 ºC min. and 60 ºC max.



3.2 ELECTRICAL ABSOLUTE RATINGS

3.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCCS	-0.3	+4.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	VCCS+0.5	V	
Converter Input Voltage	LED_VCCS	-0.3	(25)	V	(1)
Converter Control Signal Voltage	LED_PWM,	-0.3	(4)	V	(1)
Converter Control Signal Voltage	LED_EN	-0.3	(4)	V	(1)

Note (1) Stresses beyond those listed in above “ELECTRICAL ABSOLUTE RATINGS” may cause permanent damage to the device. Normal operation should be restricted to the conditions described in “ELECTRICAL CHARACTERISTICS”.

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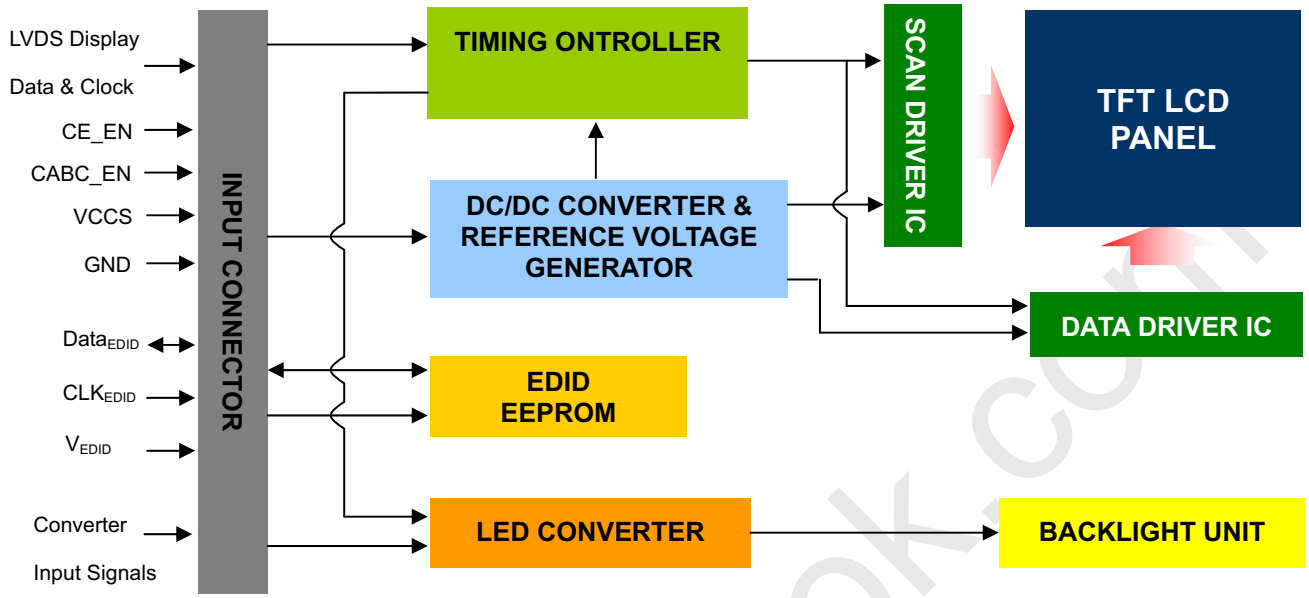
4. ELECTRICAL SPECIFICATIONS

4.1 FUNCTION BLOCK DIAGRAM



4.2. INTERFACE CONNECTIONS

PIN ASSIGNMENT

Pin	Symbol	Description	Remark
1	NC	No Connection (Reserve)	
2	VCCS	Power Supply (3.3V typ.)	
3	VCCS	Power Supply (3.3V typ.)	
4	VEDID	DDC 3.3V power	
5	NC	No Connection (Reserved for CMI test)	
6	CLKEDID	DDC clock	
7	DATAEDID	DDC data	
8	Rxin0-	LVDS differential data input	R0-R5, G0
9	Rxin0+	LVDS differential data input	
10	VSS	Ground	
11	Rxin1-	LVDS differential data input	G1~G5, B0, B1
12	Rxin1+	LVDS differential data input	
13	VSS	Ground	
14	Rxin2-	LVDS Differential Data Input	B2-B5,HS,VS, DE
15	Rxin2+	LVDS Differential Data Input	
16	VSS	Ground	
17	RxCLK-	LVDS differential clock input	LVDS CLK
18	RxCLK+	LVDS differential clock input	
19	CE_EN	Color Engine Enable Input	
20	NC	No Connection (Reserve)	
21	NC	No Connection (Reserve)	
22	VSS	Ground	
23	NC	No Connection (Reserve)	

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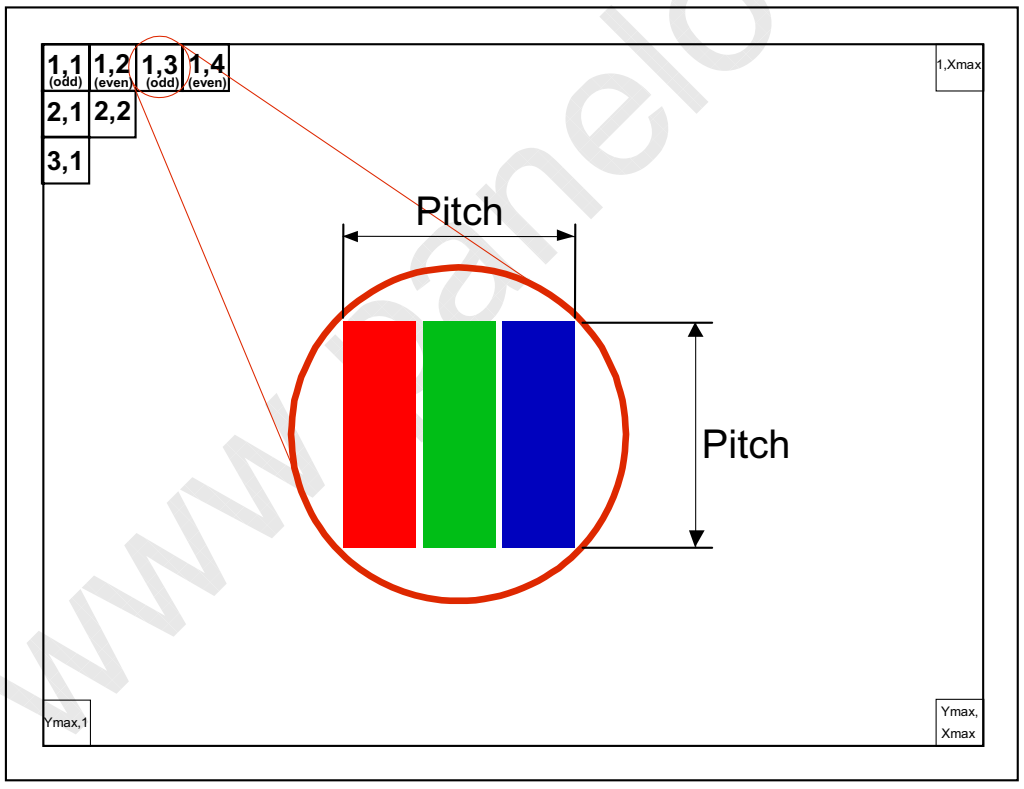
24	NC	No Connection (Reserve)	
25	VSS	Ground	
26	NC	No Connection (Reserve)	
27	NC	No Connection (Reserve)	
28	VSS	Ground	
29	NC	No Connection (Reserve)	
30	NC	No Connection (Reserve)	
31	LED_GND	LED Ground	
32	LED_GND	LED Ground	
33	LED_GND	LED Ground	
34	NC	No Connection (Reserve)	
35	LED_PWM	PWM Control Signal of LED Converter	
36	LED_EN	Enable Control Signal of LED Converter	
37	CABC_EN	CABC Enable Input	
38	LED_VCCS	LED Power Supply	
39	LED_VCCS	LED Power Supply	
40	LED_VCCS	LED Power Supply	

Note (1) The first pixel is odd as shown in the following figure.



Note (2) The setting of Color engine and CABC function are as follows.

Pin	Enable	Disable
CE_EN	Hi	Lo or Open
CABC_EN	Hi	Lo or Open

Hi = High level, Lo = Low level.

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4.3 ELECTRICAL CHARACTERISTICS

4.3.1 LCD ELETRONICS SPECIFICATION

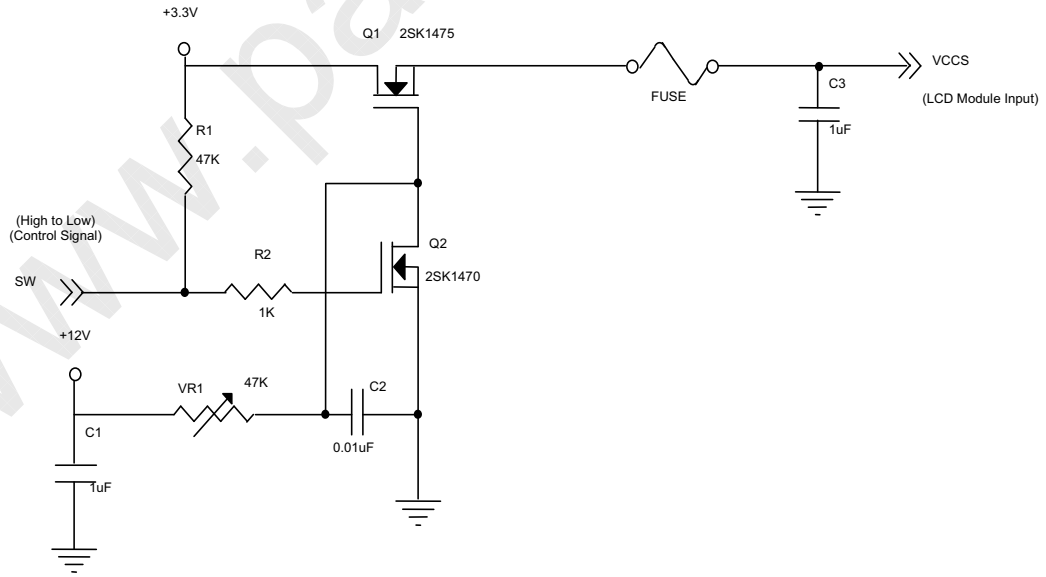
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		VCCS	3.0	3.3	3.6	V	(1)-
Ripple Voltage		V_{RP}	-	-	100	mV	(1)-
CE_EN Input Voltage	High Level	V_{IHCE}	(2.3)	-	(3.6)	V	
	Low Level	V_{ILCE}	(0)	-	(0.5)	V	
CABC_EN Input Voltage	High Level	V_{IHCABC}	(2.3)	-	(3.6)	V	
	Low Level	V_{ILCABC}	(0)	-	(0.5)	V	
Inrush Current		I_{RUSH}	-	-	1.5	A	(1),(2)
Power Supply Current	Mosaic	Icc	-	(250)	(280)	mA	(3)a
	Black		-	(270)	(300)	mA	(3)b
	Win XP		-	(260)	(290)	mA	
	1H2V		-	(320)	(340)	mA	

Note (1) The ambient temperature is Ta = 25 ± 2 ºC.

Note (2) I_{RUSH}: the maximum current when VCCS is rising

I_{IS}: the maximum current of the first 100ms after power-on

Measurement Conditions: Shown as the following figure. Test pattern: black.



VCCS rising time is 0.5ms

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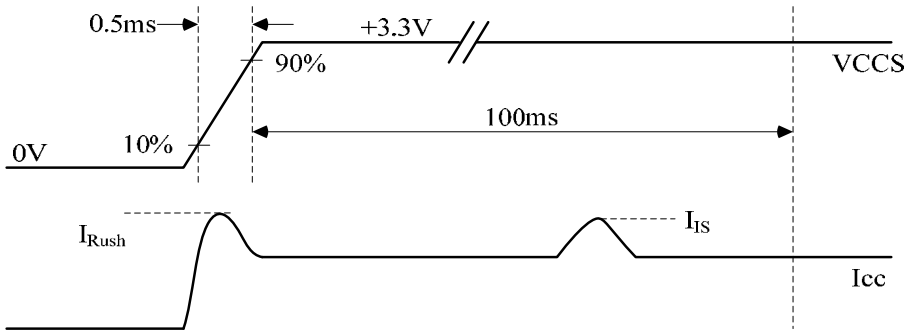

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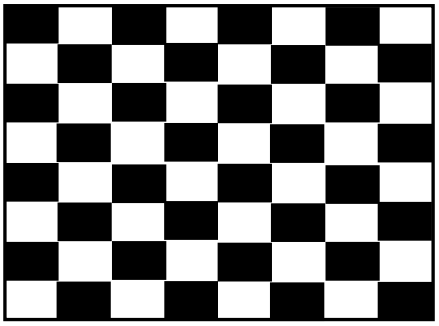
Note (3) The specified power supply current is under the conditions at VCCS = 3.3 V, Ta = 25 ± 2 ºC, DC Current and f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. Mosaic Pattern



Active Area

b. Black Pattern

Active Area

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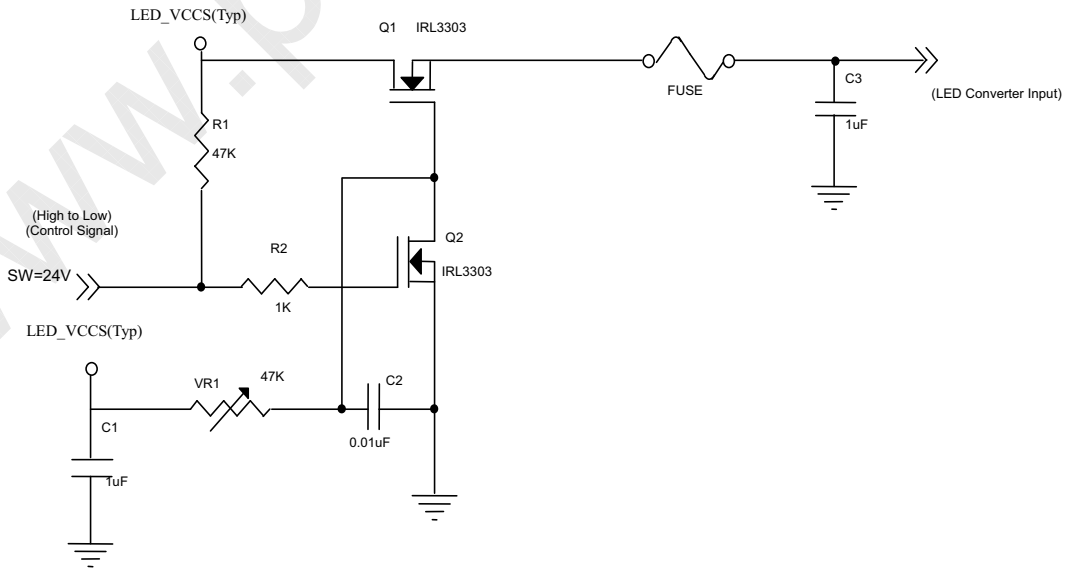
4.3.2 LED CONVERTER SPECIFICATION

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Converter Input power supply voltage		LED_Vccs	(6.0)	(12.0)	(21.0)	V	
Converter Inrush Current		$ILED_{RUSH}$	-	-	(1.5)	A	(1)
EN Control Level	Backlight On		(2.2)	-	(3.6)	V	
	Backlight Off		(0)	-	(0.5)	V	
PWM Control Level	PWM High Level		(2.2)	-	(3.6)	V	
	PWM Low Level		(0)	-	(0.5)	V	
PWM Control Duty Ratio			(10)	-	(100)	%	
			(1)	-	(100)	%	(2)
PWM Control Permissive Ripple Voltage		VPWM_pp	-	-	100	mV	
PWM Control Frequency		f_{PWM}	100	-	500	Hz	(3)
LED Power Current	LED_VCCS =Typ.	ILED	(181)	(213)	(247)	mA	(4)

Note (1) $ILED_{RUSH}$: the maximum current when LED_VCCS is rising,

$ILED_{IS}$: the maximum current of the first 100ms after power-on,

Measurement Conditions: Shown as the following figure. LED_VCCS = Typ, Ta = 25 ± 2 ºC, f_{PWM} = 200 Hz, Duty=100%.



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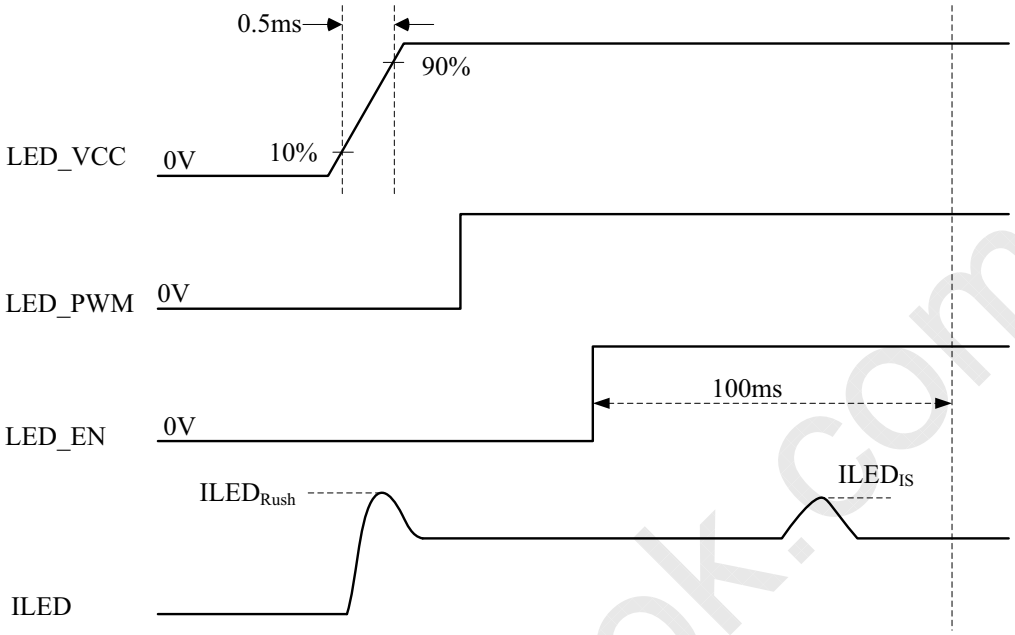
VLED rising time is 0.5ms



Note (2) If the PWM control duty ratio is less than 10%, it is difficult to control the brightness linearity.

Note (3) If PWM control frequency is applied in the range less than 1KHz, the "waterfall" phenomenon on the screen may be found. To avoid the issue, it's a suggestion that PWM control frequency should follow the criterion as below.

PWM control frequency f_{PWM} should be in the range

$$(N+0.33)*f \leq f_{PWM} \leq (N+0.67)*f$$

N : Integer $(N \geq 3)$

f : Frame rate

Note (4) The specified LED power supply current is under the conditions at "LED_VCCS = Typ.", Ta = 25 ± 2 ºC, f_{PWM} = 200 Hz, Duty=100%.

Note (5) Within the specified PWM control duty ratio range, CMI's LCD module can pass the following acoustic noise test. The test condition refers to ISO-7779 and is shown as the following figure. LED_VCCS = Min., Ta = 25 ± 2 ºC, (D_{PWM}, f_{PWM}) = (Max, Max); (Max, Min); (Min, Max); (Min, Min), while operating on black pattern with CMI's own pattern generator. All sound pressure of scanning band 630Hz - 20KHz should be kept under 20dBA. If lower noise level is required, more technical discussion is needed.

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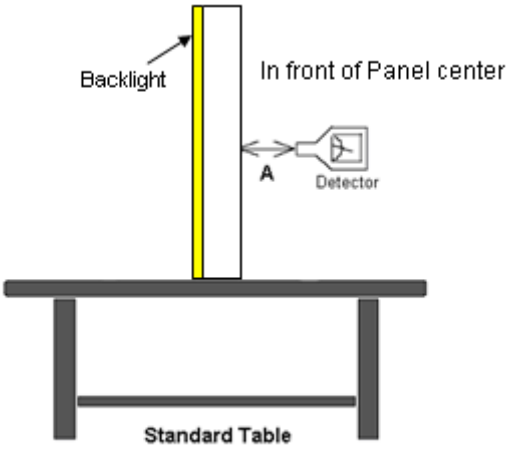


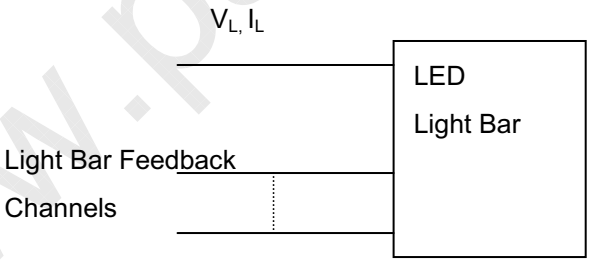
Detective Position : A= 10cm

4.3.3 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Power Supply Voltage	V_L	27	28.8	30.6	V	(1)(2)(Duty100%)
LED Light Bar Power Supply Current	I_L	76	80	84	mA	
Power Consumption	P_L	2.052	2.304	2.57	W	(3)
LED Life Time	L_{BL}	15000	-	-	Hrs	(4)

Note (1) LED current is measured by utilizing a high frequency current meter as shown below :



Note (2) For better LED light bar driving quality, it is recommended to utilize the adaptive boost converter with current balancing function to drive LED light-bar.

Note (3) $P_L = I_L \times V_L$ (Without LED converter transfer efficiency)

Note (4) The lifetime of LED is defined as the time when it continues to operate under the conditions at Ta = 25 ±2 °C and I_L = 20 mA(Per EA) until the brightness becomes ≦ 50% of its original value.

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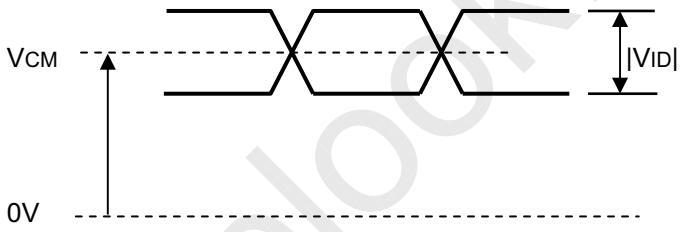
4.4 LVDS INPUT SIGNAL TIMING SPECIFICATIONS

4.4.1 LVDS DC SPECIFICATIONS

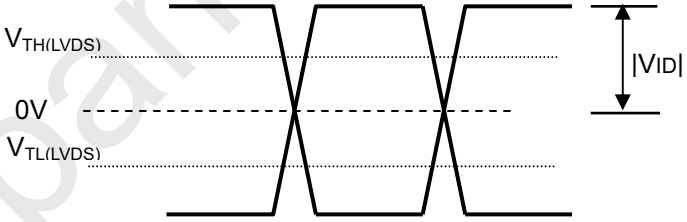
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LVDS Differential Input High Threshold	$V_{TH(LVDS)}$	-	-	+100	mV	(1), V_{CM}=1.2V
LVDS Differential Input Low Threshold	$V_{TL(LVDS)}$	-100	-	-	mV	(1) V_{CM}=1.2V
LVDS Common Mode Voltage	V_{CM}	(1.125)	-	(1.375)	V	(1)
LVDS Differential Input Voltage	$\|V_{ID}\|$	100	-	600	mV	(1)
LVDS Terminating Resistor	R_T		100		Ohm	-

Note (1) The parameters of LVDS signals are defined as the following figures.

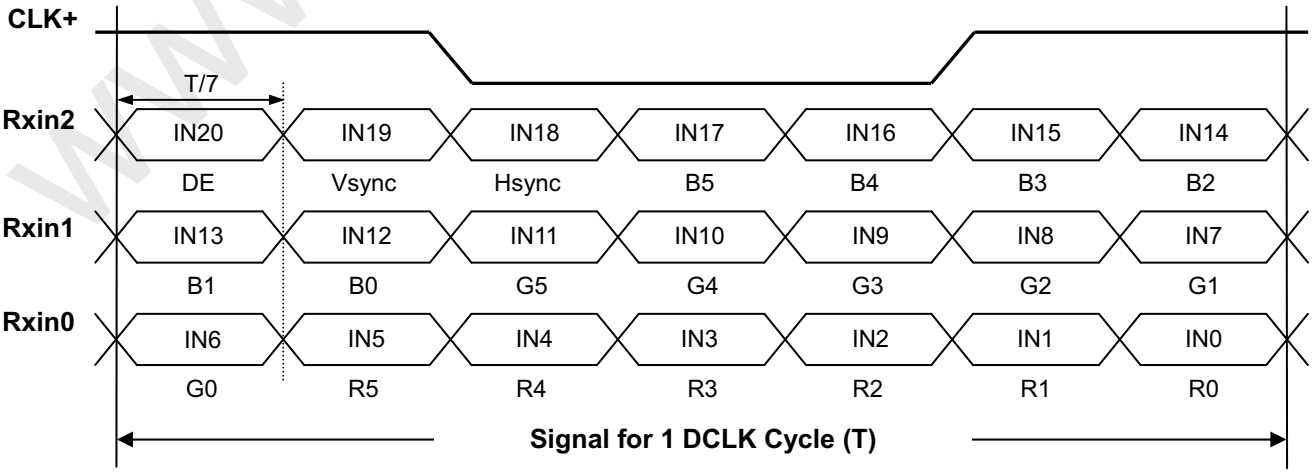
Single Ended



Differential



4.4.2 LVDS DATA FORMAT



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4.4.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

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4.5 DISPLAY TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

Timing 1. 60Hz

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	(62.4)	(69.3)	(72.8)	MHz	-
DE	Vertical Total Time	TV	(776)	(788)	(793)	TH	-
	Vertical Active Display Period	TVD	(768)	(768)	(768)	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	(20)	TV-TVD	TH	-
	Horizontal Total Time	TH	(1456)	(1466)	(1492)	Tc	-
	Horizontal Active Display Period	THD	(1366)	(1366)	(1366)	Tc	-
	Horizontal Active Blanking Period	THB	TH-THD	(100)	TH-THD	Tc	-

Timing 2: 50Hz

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	(57.418)	(60.44)	(63.462)	MHz	-
DE	Vertical Total Time	TV	(776)	(788)	(793)	TH	-
	Vertical Active Display Period	TVD	(768)	(768)	(768)	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	(20)	TV-TVD	TH	
	Horizontal Total Time	TH	(1523)	(1534)	(1561)	Tc	-
	Horizontal Active Display Period	THD	(1366)	(1366)	(1366)	Tc	-
	Horizontal Active Blanking Period	THB	TH-THD	(168)	TH-THD	Tc	

Timing 3: 40Hz

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	(45.93	(48.35)	(50.77)	MHz	-
DE	Vertical Total Time	TV	(776)	(788)	(793)	TH	-
	Vertical Active Display Period	TVD	(768)	(768)	(768)	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	(20)	TV-TVD	TH	
	Horizontal Total Time	TH	(1523)	(1534)	(1561)	Tc	-
	Horizontal Active Display Period	THD	(1366)	(1366)	(1366)	Tc	-
	Horizontal Active Blanking Period	THB	TH-THD	(168)	TH-THD	Tc	

Note (1) Because this module is operated by DE only mode, Hsync and Vsync are ignored.

(2) The module can be operated at 50Hz and 40Hz refresh rate. However, there might be some side effect like flicker, brightness change or etc.

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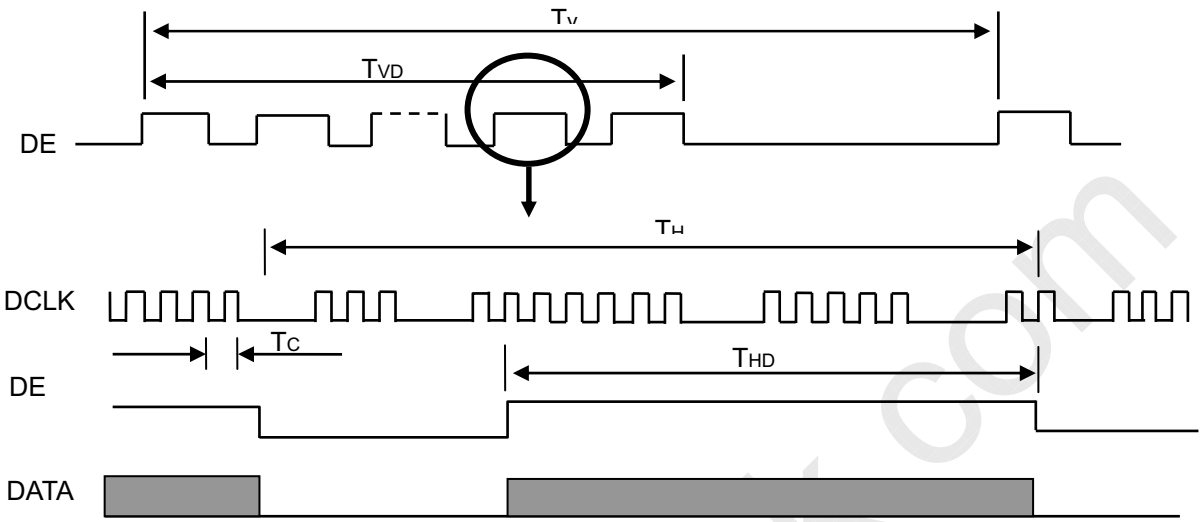
INPUT SIGNAL TIMING DIAGRAM



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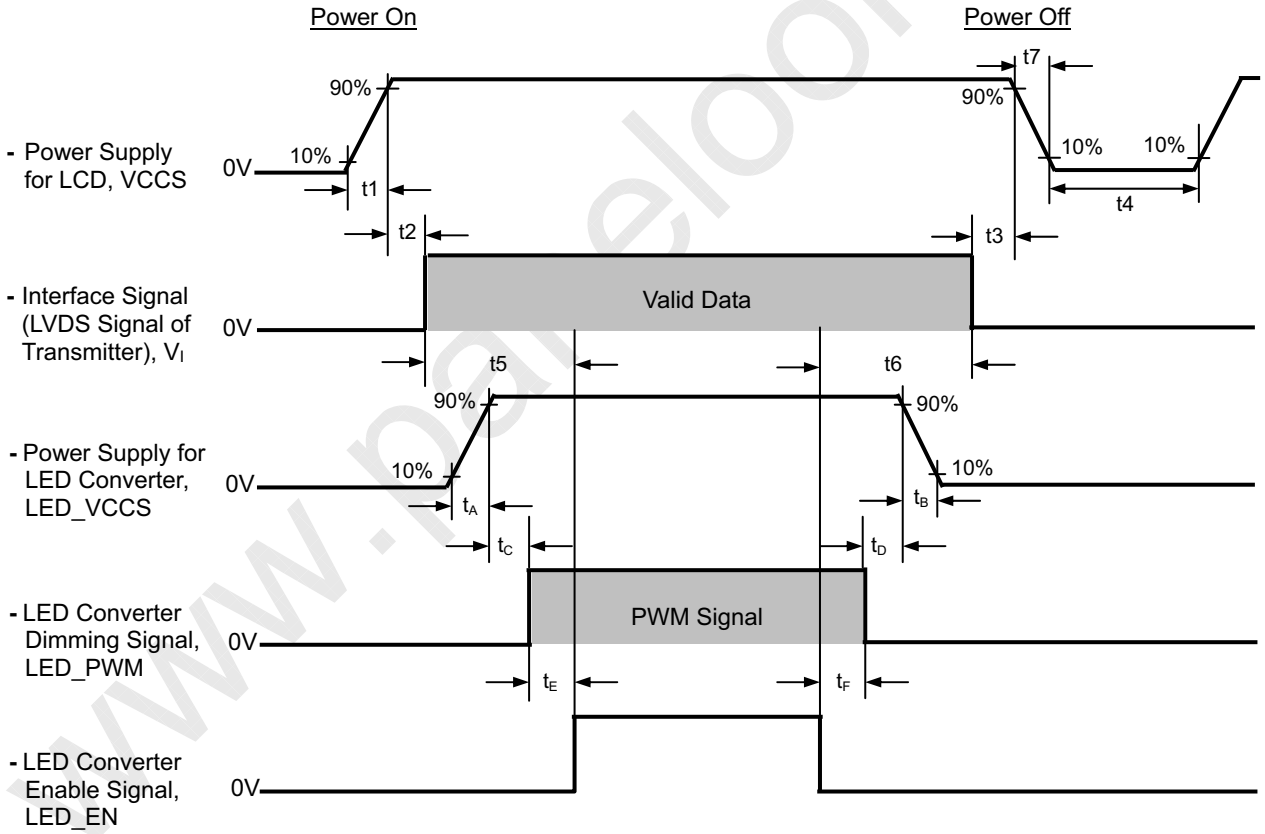
4.6 POWER ON/OFF SEQUENCE

The power sequence specifications are shown as the following table and diagram.

Symbol	Value			Unit	Note
	Min.	Typ.	Max.		
t1	(0.5)	-	(10)	ms	
t2	(0)	-	(50)	ms	
t3	(0)	-	-	ms	
t4	(150)	-	-	ms	
t5	200	-	-	ms	
t6	(0)	-	-	ms	
t7	(0)	-	(10)	ms	
t_A	(0.5)	-	(10)	ms	
t_B	(0)	-	-	ms	
t_C	(0)	-	-	ms	
t_D	(0)	-	-	ms	
t_E	(0)	-	-	ms	
t_F	(0)	-	-	ms	



Note (1) Please don't plug or unplug the interface cable when system is turned on.

Note (2) Please avoid floating state of the interface signal during signal invalid period.

Note (3) It is recommended that the backlight power must be turned on after the power supply for LCD and the interface signal is valid.

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5. OPTICAL CHARACTERISTICS

5.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current	I_L	80	mA

The measurement methods of optical characteristics are shown in Section 5.2. The following items should be measured under the test conditions described in Section 5.1 and stable environment shown in Note (5). The measurement condition can refer to Page 12, Backlight Unit 4.3.3

5.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ_x=0°, θ_Y =0° Viewing Normal Angle	300	500	-	-	(2), (5) ,(7)
Response Time		T_R		-	3	8	ms	(3) ,(7)
		T_F		-	8	13	ms	
Average Luminance of White		L_{AVE}		170	200	-	cd/m^2	(4), (6) ,(7)
Color Chromaticity	Red	Rx		Typ – 0.03	0.586	Typ + 0.03	-	(1) ,(7)
		Ry			0.355		-	
	Green	Gx			0.317		-	
		Gy			0.563		-	
	Blue	Bx			0.16		-	
		By			0.144		-	
	White	Wx			0.313		-	
		Wy			0.329		-	
Color gamut		C.G		42	45		%	(8) ,(7)
Viewing Angle	Horizontal	θ_x+	CR≥10	40	45		Deg.	(1),(5),(7)
		θ_x-		40	45	-		
	Vertical	θ_Y+		15	20	-		
		θ_Y-		40	45	-		
White Variation		δW_{5p}	θ_x=0°, θ_Y =0°	80	-	-	%	(5),(6), (7)
		δW_{13p}	θ_x=0°, θ_Y =0°	65		-	%	(5),(6), (7)

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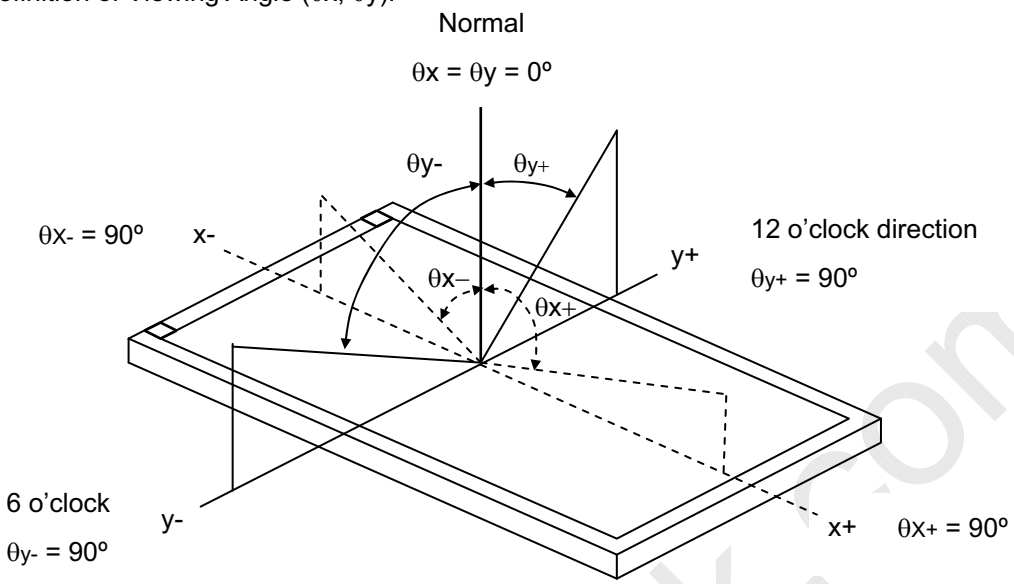
Note (1) Definition of Viewing Angle (θx, θy):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

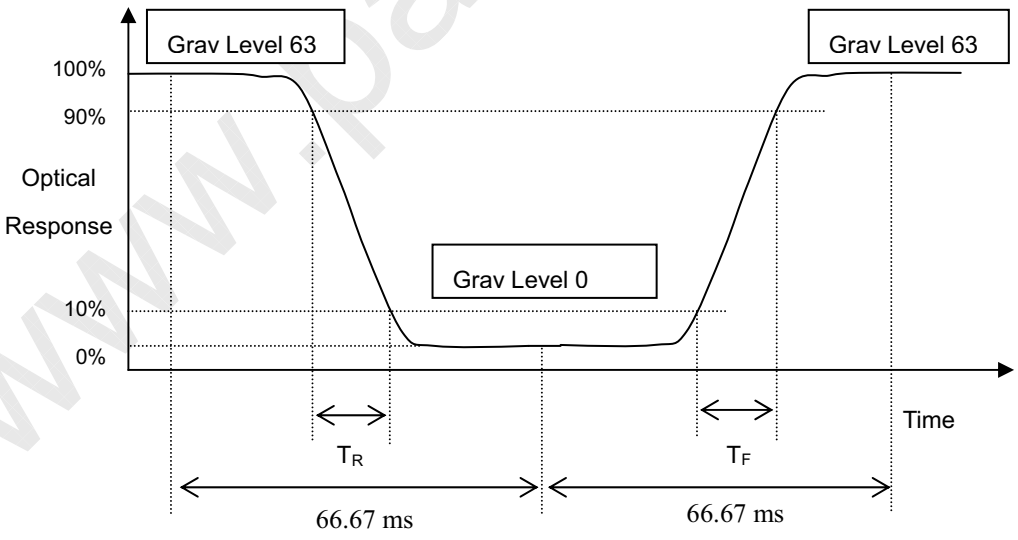
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

CR = CR (1)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R, T_F):



Note (4) Definition of Average Luminance of White (L_{AVE}):

Measure the luminance of gray level 63 at 5 points

L_{AVE} = [L (1)+ L (2)+ L (3)+ L (4)+ L (5)] / 5

L (x) is corresponding to the luminance of the point X at Figure in Note (6)

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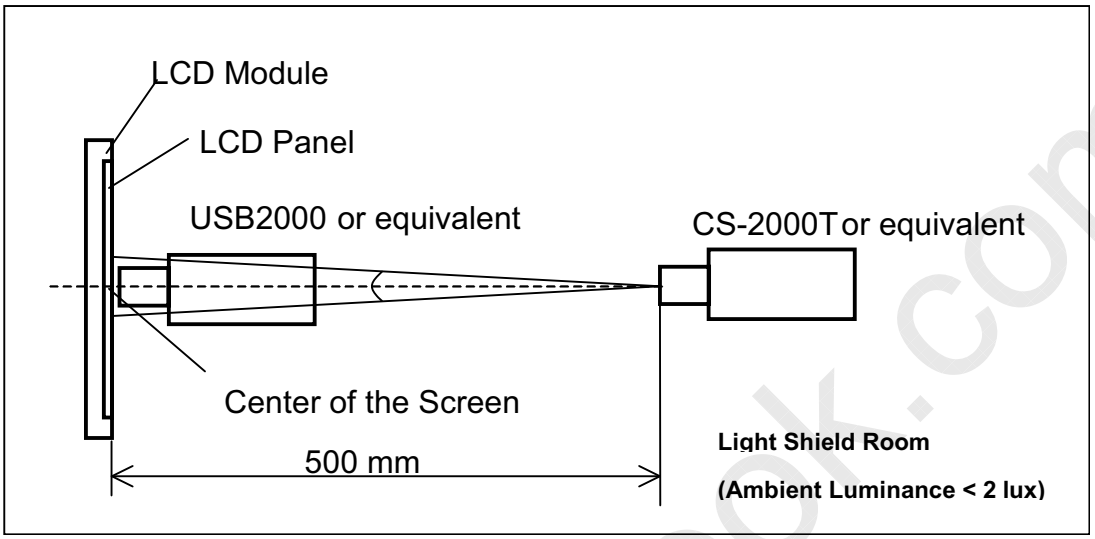
Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.

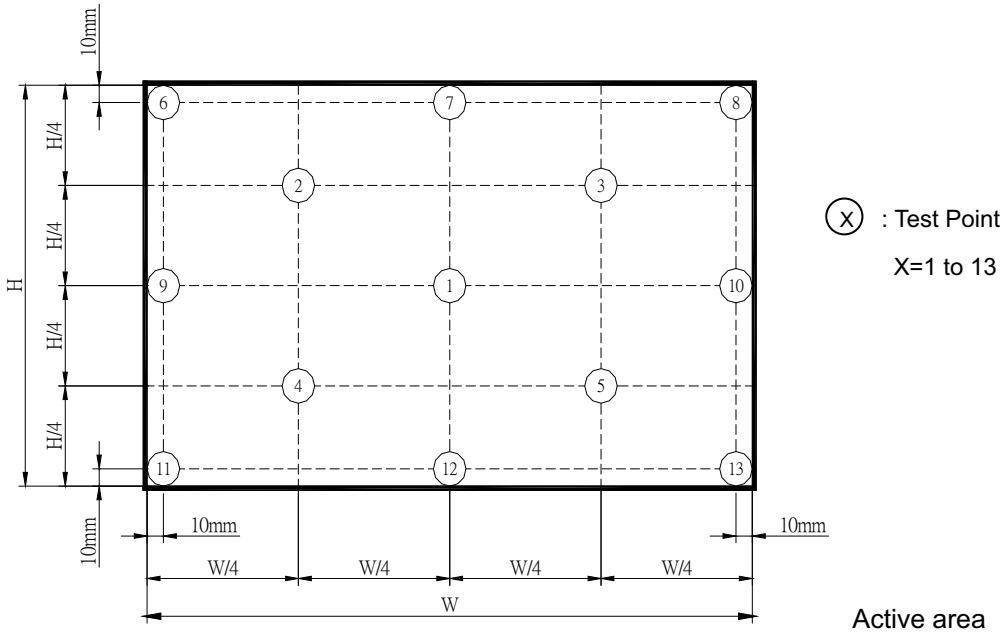


Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

δW_{5p} = {Minimum [L (1) ~ L (5)] / Maximum [L (1) ~ L (5)]}*100%

δW_{13p} = {Minimum [L (1) ~ L (13)] / Maximum [L (1) ~ L (13)]}*100%



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Note (7) The listed optical specifications refer to the initial value of manufacture, but the condition of the specifications after long-term operation will not be warranted.

Note (8) Definition of color gamut (C.G%):

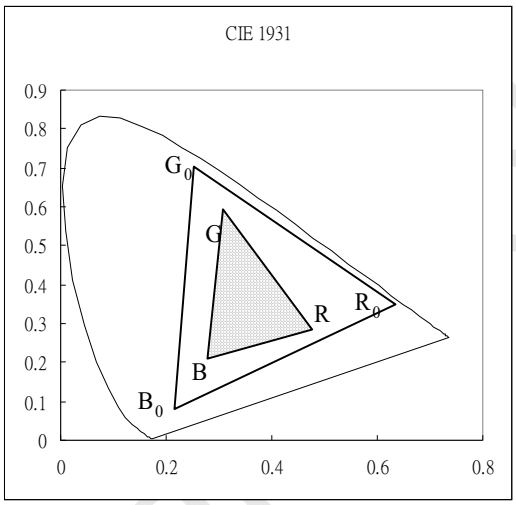
C.G%= R G B / R_0 G_0 B_0,*100%

R_0, G_0, B_0 : color coordinates of red, green, and blue defined by NTSC, respectively.

R, G, B : color coordinates of module on 63 gray levels of red, green, and blue, respectively.

R_0 G_0 B_0 : area of triangle defined by R_0, G_0, B_0

. R G B: area of triangle defined by R, G, B



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6. RELIABILITY TEST ITEM

Test Item	Test Condition	Note
High Temperature Storage Test	60ºC, 240 hours	(1) (2)
Low Temperature Storage Test	-20ºC, 240 hours	
Thermal Shock Storage Test	-20ºC, 0.5hour←→60℃, 0.5hour; 100cycles, 1hour/cycle	
High Temperature Operation Test	50ºC, 240 hours	
Low Temperature Operation Test	0ºC, 240 hours	
High Temperature & High Humidity Operation Test	50ºC, RH 80%, 240hours	
ESD Test (Operation)	150pF, 330Ω, 1sec/cycle Condition 1 : Contact Discharge, ±8KV Condition 2 : Air Discharge, ±15KV	(1)
Shock (Non-Operating)	220G, 2ms, half sine wave,1 time for each direction of ±X,±Y,±Z	(1)(3)
Vibration (Non-Operating)	1.5G / 10-500 Hz, Sine wave, 30 min/cycle, 1cycle for each X, Y, Z	(1)(3)

Note (1) criteria : Normal display image with no obvious non-uniformity and no line defect.

Note (2) Evaluation should be tested after storage at room temperature for more than two hour

Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

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7. PACKING

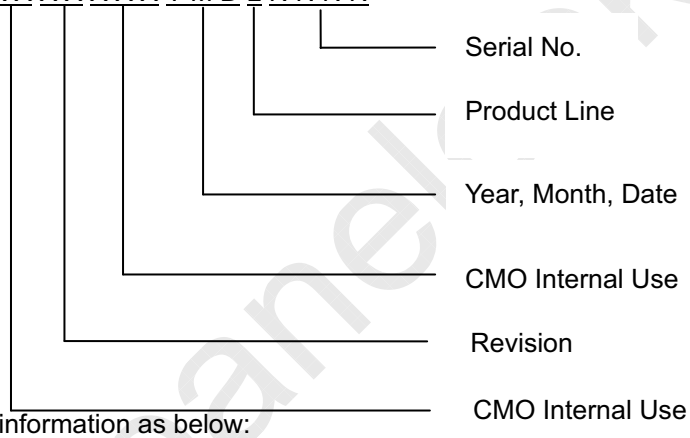
7.1 MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.

(a) Model Name: N140BGE - L31

(b) Revision: Rev. XX, for example: C1, C2 …etc.

(c) Serial ID: X X X X X X Y M D L N N N N



Serial ID includes the information as below:

(a) Manufactured Date: Year: 0~9, for 2010~2019

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U

(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

(d) Product Line: 1 -> Line1, 2 -> Line 2, …etc.

For barcode content

11S PPPPPPP Z1Z HHH SSSSSS YMM

(a) 11S: Fixed characters.

(b) PPPPPPP (P/N): Customer part number 93P5696, fixed characters

(c) Z1Z: Fixed characters.

(d) HHH (Header Code): HGA

(e) SSSSSS: Series number.

(f) YMM: Y: The last character of year. MM: Month

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7.2 CARTON

Box Dimensions : 435(L)*350(W)*320(H)
Weight: Approx. 9.6kg(20 module .per. 1 box)

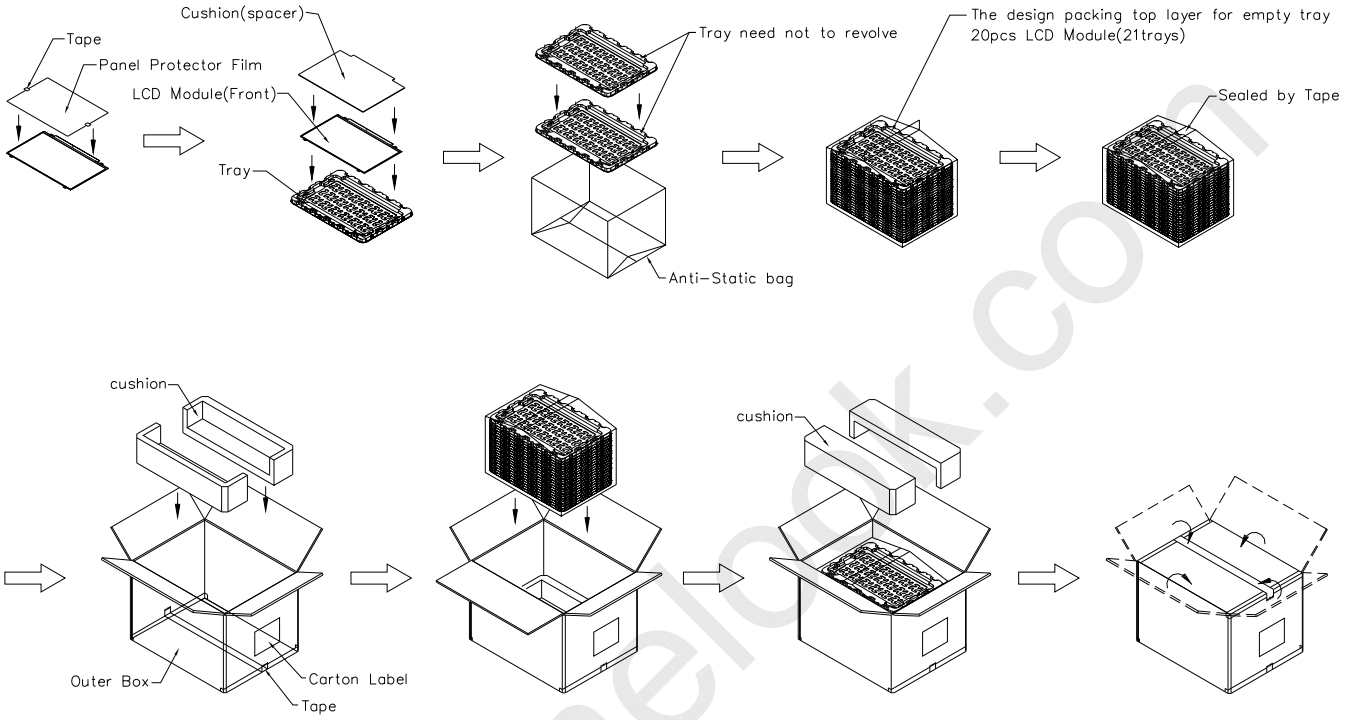

Figure. 7-2 Packing method

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7.3 PALLET

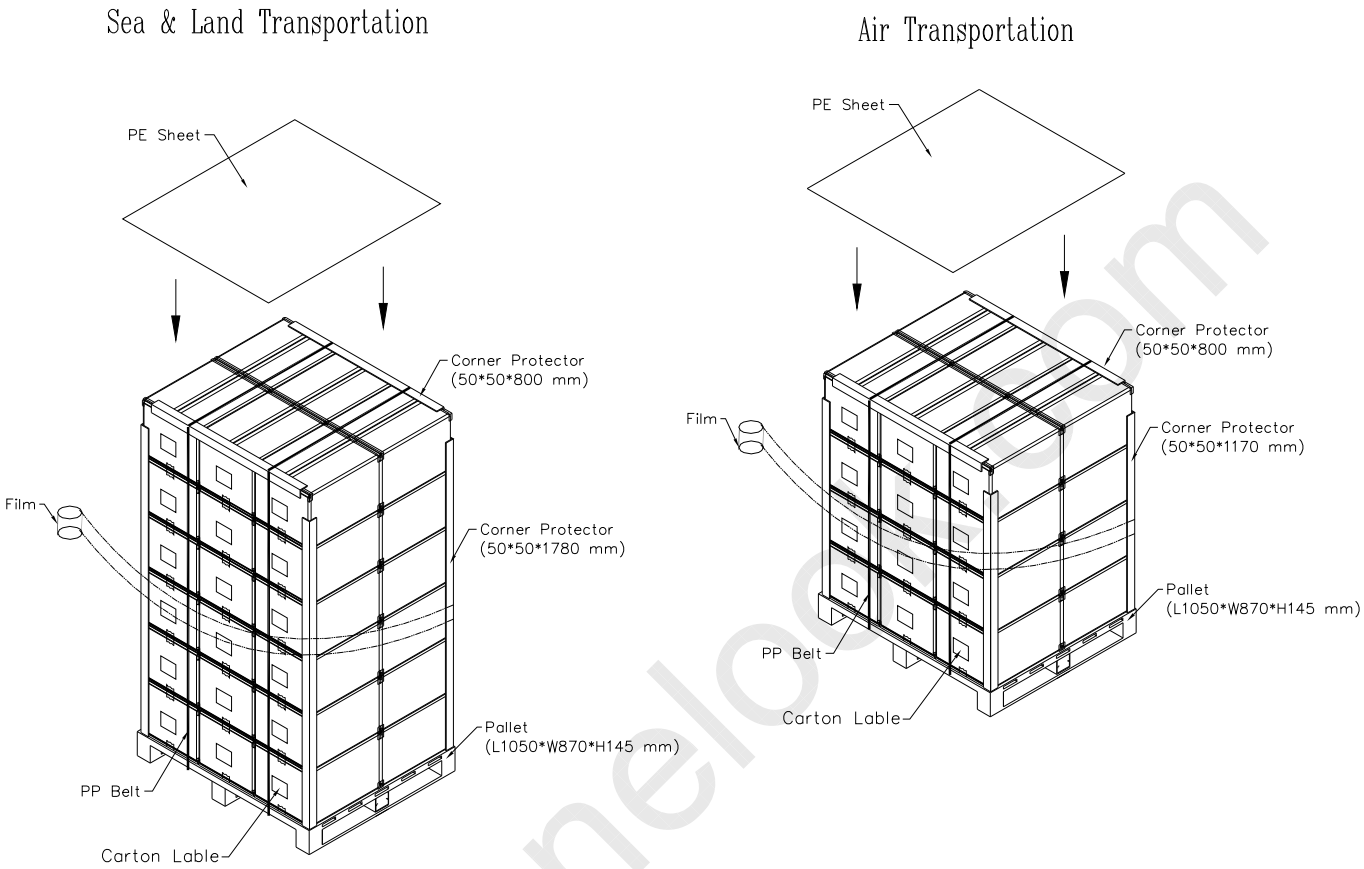

Figure. 7-3 Packing method

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8. PRECAUTIONS

8.1 HANDLING PRECAUTIONS

(1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.

(2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.

(3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.

(4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.

(5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.

(6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.

(9) Do not disassemble the module.

(10) Do not pull or fold the LED wire.

(11) Pins of I/F connector should not be touched directly with bare hands.

8.2 STORAGE PRECAUTIONS

(1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

(2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.

(3) It may reduce the display quality if the ambient temperature is lower than 10 ºC. For example, the response time will become slowly, and the starting voltage of LED will be higher than the room temperature.

8.3 OPERATION PRECAUTIONS

(1) Do not pull the I/F connector in or out while the module is operating.

(2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.

(3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with converter. Do not disassemble the module or insert anything into the Backlight unit.

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Appendix. EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the VESA Plug & Display and FPDI standards.

Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
0	0	Header	00	00000000
1	1	Header	FF	11111111
2	2	Header	FF	11111111
3	3	Header	FF	11111111
4	4	Header	FF	11111111
5	5	Header	FF	11111111
6	6	Header	FF	11111111
7	7	Header	00	00000000
8	8	EISA ID manufacturer name (“CMO”)	0D	00001101
9	9	EISA ID manufacturer name (Compressed ASCII)	AF	10101111
10	0A	ID product code (N140BGE-L31)	67	01100111
11	0B	ID product code (hex LSB first; N140BGE-L31)	14	00010100
12	0C	ID S/N (fixed “0”)	00	00000000
13	0D	ID S/N (fixed “0”)	00	00000000
14	0E	ID S/N (fixed “0”)	00	00000000
15	0F	ID S/N (fixed “0”)	00	00000000
16	10	Week of manufacture (fixed week code)	26	00100110
17	11	Year of manufacture (fixed year code)	14	00010100
18	12	EDID structure version # (“1”)	01	00000001
19	13	EDID revision # (“3”)	03	00000011
20	14	Video I/P definition (“digital”)	80	10000000
21	15	Active area horizontal 31 cm	1F	00011111
22	16	Active area vertical 18 cm	12	00010010
23	17	Display Gamma (Gamma = ”2.2”)	78	01111000
24	18	Feature support (“Active off, RGB Color”)	0A	00001010
25	19	Red/Green (Rx1, Rx0, Ry1, Ry0, Gx1, Gx0, Gy1, Gy0)	05	00000101
26	1A	Blue/White (Bx1, Bx0, By1, By0, Wx1, Wx0, Wy1, Wy0)	35	00110101
27	1B	Red-x (Rx = “0.586”)	96	10010110
28	1C	Red-y (Ry = “0.355”)	5B	01011011
29	1D	Green-x (Gx = ”0.317”)	51	01010001
30	1E	Green-y (Gy = ”0.563”)	90	10010000
31	1F	Blue-x (Bx = ”0.160”)	29	00101001
32	20	Blue-y (By = ”0.144”)	24	00100100
33	21	White-x (Wx = ”0.313”)	50	01010000
34	22	White-y (Wy = ”0.329”)	54	01010100
35	23	Established timings 1	00	00000000
36	24	Established timings 2	00	00000000
37	25	Manufacturer’s reserved timings	00	00000000
38	26	Standard timing ID # 1	01	00000001
39	27	Standard timing ID # 1	01	00000001
40	28	Standard timing ID # 2	01	00000001
41	29	Standard timing ID # 2	01	00000001

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42	2A	Standard timing ID # 3	01	00000001
43	2B	Standard timing ID # 3	01	00000001
44	2C	Standard timing ID # 4	01	00000001
45	2D	Standard timing ID # 4	01	00000001
46	2E	Standard timing ID # 5	01	00000001
47	2F	Standard timing ID # 5	01	00000001
48	30	Standard timing ID # 6	01	00000001
49	31	Standard timing ID # 6	01	00000001
50	32	Standard timing ID # 7	01	00000001
51	33	Standard timing ID # 7	01	00000001
52	34	Standard timing ID # 8	01	00000001
53	35	Standard timing ID # 8	01	00000001
54	36	Detailed timing description # 1 Pixel clock (“71MHz”, According to VESA CVT Rev1.1)	BC	10111100
55	37	# 1 Pixel clock (hex LSB first)	1B	00011011
56	38	# 1 H active (“1366”)	56	01010110
57	39	# 1 H blank (“132”)	84	10000100
58	3A	# 1 H active : H blank (“1366 :132”)	50	01010000
59	3B	# 1 V active (”768”)	00	00000000
60	3C	# 1 V blank (”22”)	16	00010110
61	3D	# 1 V active : V blank (”768 :22”)	30	00110000
62	3E	# 1 H sync offset (”48”)	30	00110000
63	3F	# 1 H sync pulse width ("32”)	20	00100000
64	40	# 1 V sync offset : V sync pulse width (”1 : 4”)	14	00010100
65	41	# 1 H sync offset : H sync pulse width : V sync offset : V sync width (”48: 32 : 1 : 4”)	00	00000000
66	42	# 1 H image size (”309 mm”)	35	00110101
67	43	# 1 V image size (”174 mm”)	AE	10101110
68	44	# 1 H image size : V image size (”309 : 174”)	10	00010000
69	45	# 1 H boarder (”0”)	00	00000000
70	46	# 1 V boarder (”0”)	00	00000000
71	47	# 1 Non-interlaced, Normal, no stereo, Separate sync, H/V pol Negatives	18	00011000
72	48	Detailed timing description # 2	00	00000000
73	49	# 2 Flag	00	00000000
74	4A	# 2 Reserved	00	00000000
75	4B	# 2 FE (hex) defines ASCII string (Model Name “N140BGE-L31”, ASCII)	FE	11111110
76	4C	# 2 Flag	00	00000000
77	4D	# 2 1st character of name (“N”)	4E	01001110
78	4E	# 2 2nd character of name (“1”)	31	00110001
79	4F	# 2 3rd character of name (“4”)	34	00110100
80	50	# 2 4th character of name (“0”)	30	00110000
81	51	# 2 5th character of name (“B”)	42	01000010
82	52	# 2 6th character of name (“G”)	47	01000111
83	53	# 2 7th character of name (“E”)	45	01000101
84	54	# 2 8th character of name (“-”)	2D	00101101
85	55	# 2 9th character of name (“L”)	4C	01001100

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86	56	# 2 10th character of name (“3”)	33	00110011
87	57	# 2 11th character of name (“1”)	31	00110001
88	58	# 2 New line character indicates end of ASCII string	0A	00001010
89	59	# 2 Padding with “Blank” character	20	00100000
90	5A	Detailed timing description # 3	00	00000000
91	5B	# 3 Flag	00	00000000
92	5C	# 3 Reserved	00	00000000
93	5D	# 3 FE (hex) defines ASCII string (Vendor “CMO”, ASCII)	FE	11111110
94	5E	# 3 Flag	00	00000000
95	5F	# 3 1st character of string (“C”)	43	01000011
96	60	# 3 2nd character of string (“M”)	4D	01001101
97	61	# 3 3rd character of string (“O”)	4F	01001111
98	62	# 3 New line character indicates end of ASCII string	0A	00001010
99	63	# 3 Padding with “Blank” character	20	00100000
100	64	# 3 Padding with “Blank” character	20	00100000
101	65	# 3 Padding with “Blank” character	20	00100000
102	66	# 3 Padding with “Blank” character	20	00100000
103	67	# 3 Padding with “Blank” character	20	00100000
104	68	# 3 Padding with “Blank” character	20	00100000
105	69	# 3 Padding with “Blank” character	20	00100000
106	6A	# 3 Padding with “Blank” character	20	00100000
107	6B	# 3 Padding with “Blank” character	20	00100000
108	6C	Detailed timing description # 4	00	00000000
109	6D	# 4 Flag	00	00000000
110	6E	# 4 Reserved	00	00000000
111	6F	# 4 FE (hex) defines ASCII string (Model Name“N140BGE-L31”, ASCII)	FE	11111110
112	70	# 4 Flag	00	00000000
113	71	# 4 1st character of name (“N”)	4E	01001110
114	72	# 4 2nd character of name (“1”)	31	00110001
115	73	# 4 3rd character of name (“4”)	34	00110100
116	74	# 4 4th character of name (“0”)	30	00110000
117	75	# 4 5th character of name (“B”)	42	01000010
118	76	# 4 6th character of name (“G”)	47	01000111
119	77	# 4 7th character of name (“E”)	45	01000101
120	78	# 4 8th character of name (“-”)	2D	00101101
121	79	# 4 9th character of name (“L”)	4C	01001100
122	7A	# 4 10th character of name (“3”)	33	00110011
123	7B	# 4 11th character of name (“1”)	31	00110001
124	7C	# 4 New line character indicates end of ASCII string	0A	00001010
125	7D	# 4 Padding with “Blank” character	20	00100000
126	7E	Extension flag	00	00000000
127	7F	Checksum	28	00101000

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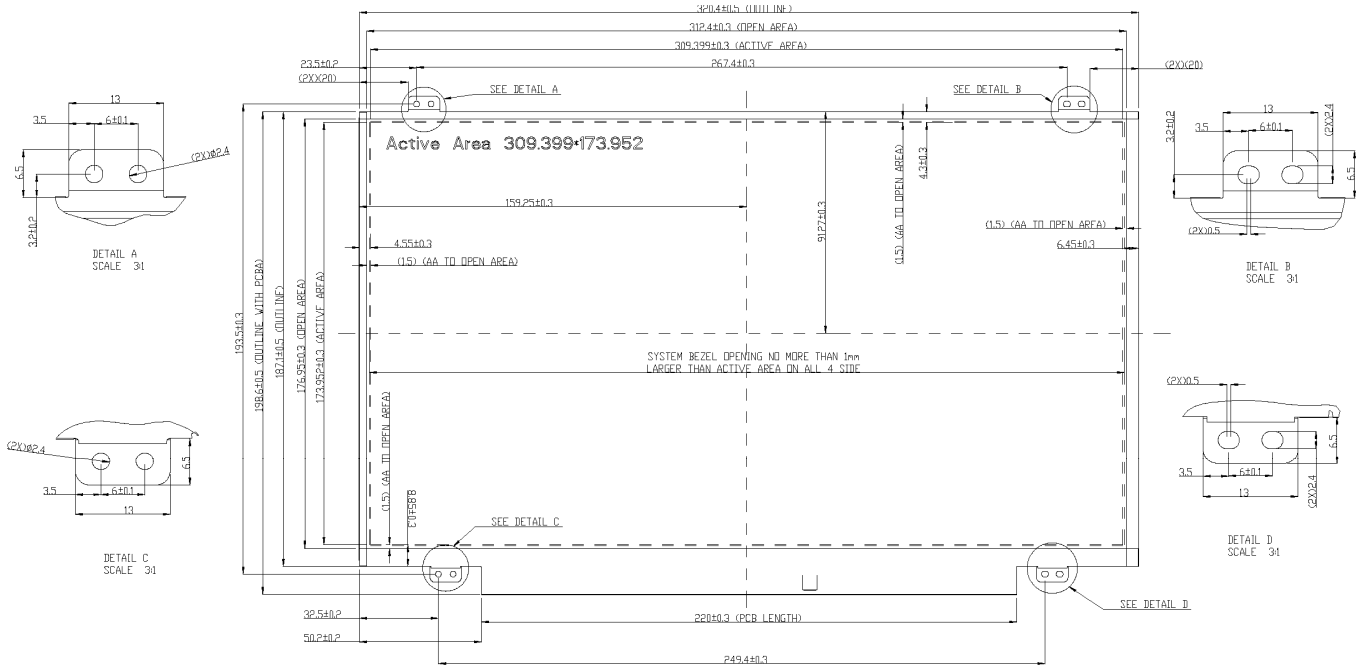
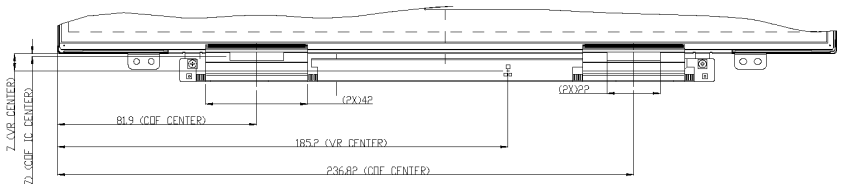
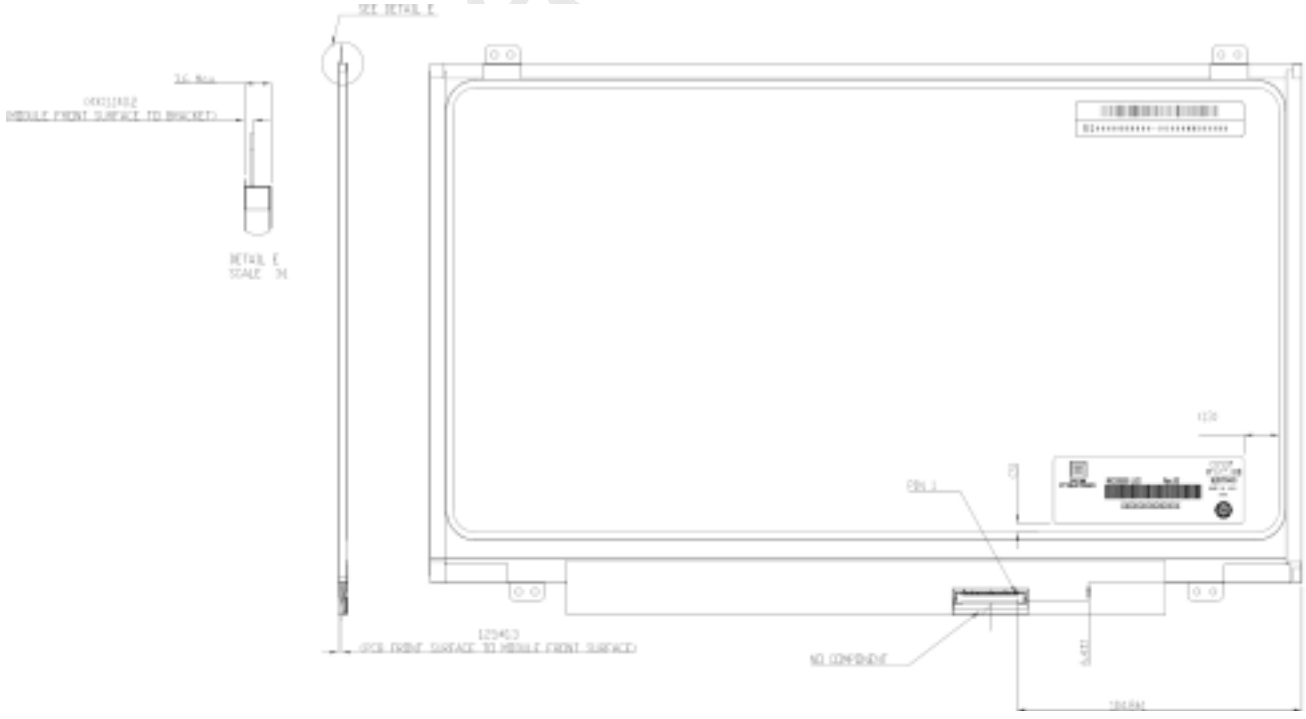
Appendix. OUTLINE DRAWING



NOTES:
1. LCD MODULE INPUT CONNECTOR : I-PEX 20455-040E-12
2. IN ORDER TO AVOID ABNORMAL DISPLAY, POOLING AND WHITE SPOT, NO OVERLAPPING IS SUGGESTED AT CABLES, ANTENNAS, CAMERA, WLAN, WAN OR FOREIGN OBJECTS OVER COF, T-CON AND VR LOCATIONS.
3. LVDS CONNECTOR IS MEASURED AT PIN1 AND ITS MATING LINE.
4. MODULE FLATNESS SPEC 0.5mm MAX.
5. "( )" MARKS THE REFERENCE DIMENSIONS.

General Tolerance Unless Specified			
0~6	±0.1	300~600	±0.3
6~30	±0.15	600~	±0.6
30~300	±0.2	ANGLE	±1.0°





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Appendix. LCD MODULE INSPECTION SPECIFICATION

A. Description

These inspection standards shall be applied to LCD Module supplied by CHI MEI Optoelectronics Corporation.

B. The environmental condition of inspection

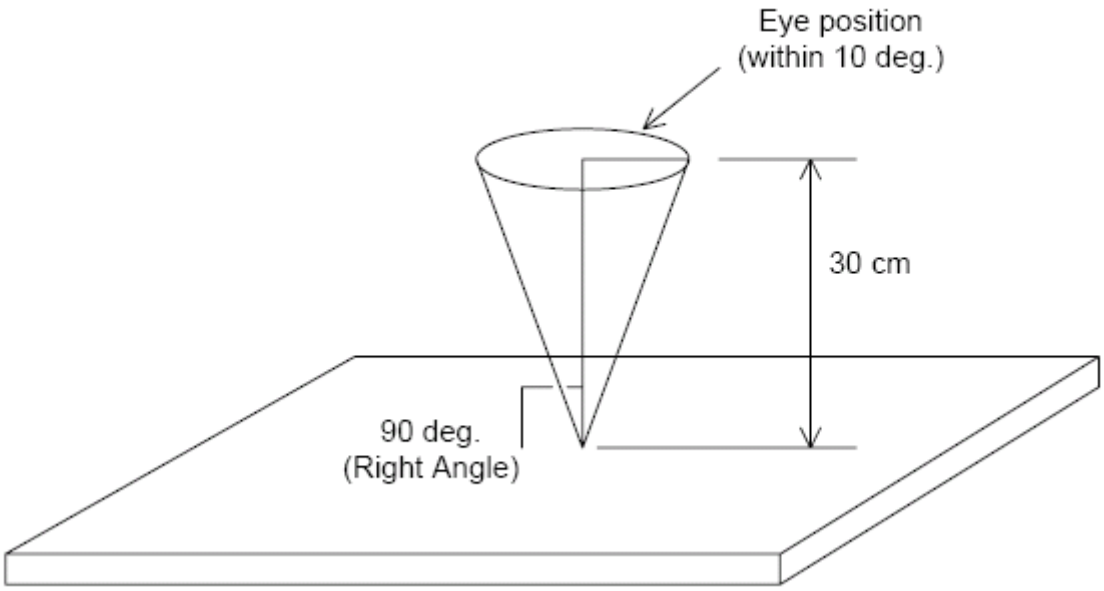
The environmental condition and visual inspection shall be conducted as below.

(1) Ambient temperature : 15~25℃

(2) Humidity: 25~75 %RH

(3) External appearance inspection shall be conducted by using a single 20W fluorescent lamp or equivalent illumination.

(4) Panel visual inspection on the operation condition for cosmetic shall be conducted at the distance 30cm between the LCD module and eyes of inspector.



(5) Using method for ND Filter

When using ND Filter for judging Mura, placing ND Filter near Mura defect and get close to the surface of LCD Panel (its distance shall be 1~2cm between the surface of Panel and ND Filter). Don't touch the surface of polarizer to avoid scratching polarizer, and then move to the defect position to judge mura by view angel 90 degree (The viewing angle shall be 90 degree to the right top of Mura defect with panel)

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C. Classification of defects

Defects are classified two types, major defect and minor defect according to the defect. And, the definition of defects is classified as below.

(1) Major defect

Any defect may result in functional failure, or reduce the usability of product for its purpose. For example, electrical failure, deformation and etc..

(2) Minor defect

A defect that is not to reduce the usability of product for its intended purpose and un-uniformity, dot defect and etc..

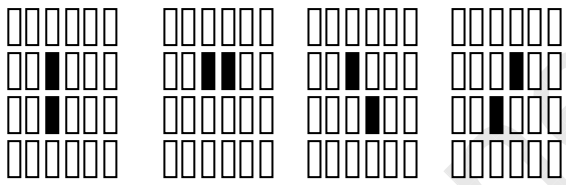
The criteria on major and/or minor judgement will be according with the classification of defects.

D. Inspection Criteria

(1) Definition of dot defect

Define spec for 2 dot adjacent and minimum distance

2-adjacent(Linked Pixels)



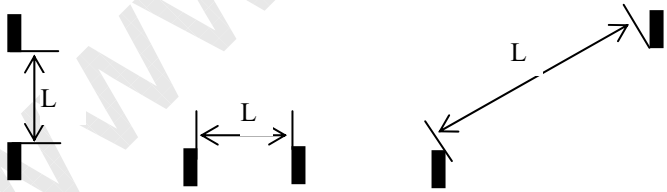
▯：sub-Pixel(R,G,B)

Minimum Distance;

Lit to Lit：L＞=15mm

Unlit to Unlit：L＞=5mm

Lit to Unlit：Not Applicable



L:Sub-Pixel to Sub-Pixel,Sub-Pixel to 2-adjacent or 2-adjacent to 2-adjacent

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(2) Display Inspection

a) Ambient Illumination: 250 Lux or more for light on inspection

b) Viewing Angle: Within LCD Viewing Angle Specification

c) Inspection Pattern (Bright dot): In black pattern

Inspection Pattern (Dark dot): In red, green , blue pattern

Items		XGA WXGA	SXGA+ WXGA+ WSXGA+	UXGA WUXGA	HD HD+ FHD
Bright dot	Random	N≦2	N≦2(G=1)	N≦2(G=0)	N≦2(G=0)
	2 dots adjacent	N≦1(G=0)	N≦0	N≦0	N≦0
	3 dots adjacent or more	N≦0	N≦0	N≦0	N≦0
Dark dot	Random	N≦3	N≦5	N≦10	N≦3
	2 dots adjacent	N≦1	N≦1	N≦2	N≦1
	3 dots adjacent or more	N≦0	N≦0	N≦0	N≦0
Distance	Lit to Lit	L≧15mm	L≧15mm	L≧15mm	L≧15mm
	Unlit to Unlit	L≧5mm	L≧5mm	L≧5mm	L≧5mm
	Lit to Unlit	Not allowable	Not allowable	Not allowable	Not allowable
Total bright and dark dot		N≦5	N≦7 (SXGA+ WXGA+) N≦9 (WSXGA+)	N≦10 (UXGA) N≦12 (WUXGA)	N≦5
Defective Dot (Lit/Unlit) : Noticeable defective dots in the office environment (250 lux) will be counted regardless of defective dot size					
Display failure (V-line/H-line/Cross line etc.)				Not allowable	
Mura	Mura defect can not show in 50% gray pattern with 8% ND-filter or judge by limit sample if necessary				

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(3) Appearance inspection

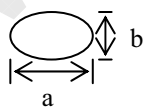
a) Ambient Illumination: 500 ~ 700 Lux

b) Viewing Angle: Backlight-Off Condition: At Right Angle To Polarizer Surface

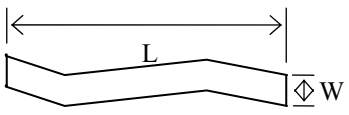
Backlight-On Condition: Within LCD Viewing Angle Specification

c) Inspection Pattern: In White and 32-Gray(Half-Gray)Screens(Backlight-On)

Items	Size(mm)	Acceptable count
1. Scratch(Line Shape) : B/L –off condition	W<0.05	Ignore
	0.05=<W<0.1; 0.3=<L=<3.0	N=<4
	0.10=<W or 3.0<L	N=0
	Shall be no visible at B/L on.	
2. Dent : B/L –off condition	D<0.2	Ignore
	0.2=<D<0.5	N=<5
	0.5=<D	N=0
	Spacing between defects shall be more than 30 mm. (0.2=<D<0.5)	
	Shall be no visible at B/L on.	
3. Bubble : B/L –off condition	D<0.2	Ignore
	0.2=<D<0.5	N=<5
	0.5=<D	N=0
	Shall be no visible at B/L on.	
4. Foreign material (Line-shape: stain inclusion) :B/L-on condition	W<0.05	Ignore
	0.05=<W<0.10; 0.3<L=<2.0	N=<4
	0.10<W or 2.0<L	N=0
	Shall be no visible at B/L on.	
5. Foreign material (Dot-shape: stain inclusion) :B/L-on condition	D<0.2	Ignore
	0.2=<D<0.5	N=<5
	0.5=<D	N=0
6. Peeling on Polizer edge :B/L-off condition	D<0.2	Ignore
	0.2=<D<0.5	N=<5
	0.5=<D	N=0
	Bubble or glue shall not be visible within PC bezel opening area with specified inspection viewing angle.	
	Continuous peeling off on polarizer edge shall be discussed.	
	Shall be no visible at B/L on.	



D=(a+b)/2



W: width, L：length

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E. External Appearance Inspection Criteria

Item	Contents	
Screw	Parts mounting, incomplete assembly, deformation, oxidized, crooked or rusty is not permitted.	
CCFT cable	Cable not continuous、Break-off 、Connector Burn-off /Break-off	
Metal frame (Bezel)	Scratch	*Noticeable scratch and exfoliation coating are not permitted. *The oxidized metal is not permitted.
	Incomplete assembly is not permitted.	
Backlight	Scratch	The scratch which may cause a problem in practical use is not permitted.
	Break-off	Breaking off is not permitted.
	Crack	The crack is not permitted.
Stain on Polarizer	The stain which can't be wiped off is not permitted.	
Tape/Label	Incorrect position, missed label is not permitted.	
Connector	Oxidized/rusty connector is not permitted.	
Outline size	Spec. out is not permitted.	

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F. Classification of defects

Inspection Item	Criteria and Description	Defect type
Vertical line	Signal input, vertical line off or irregular V-line appears	major
Horizontal line	Signal input, horizontal line off or irregular H-line appears	major
Cross line	Pattern signal input, a correct display is not obtained	major
No display	Signal input, display is dead	major
Irregular display	Pattern signal input, a correct display is not obtained	major
Dots defect	Exceed specified standards	minor
Scratch and Dent on polarizer	Exceed specified standards	minor
Foreign material	Exceed specified standards	minor
Mura	Mura defect can not show in 50% gray pattern with 8% ND-filter or judge by limit sample if necessary	minor
External Appearance	Rust, deformation, irregular plating, coating missing etc. A appearance defect that do not affect function or performance	minor
Bezel claw	Bezel claw missing or not bent	major
Polarizer bubble	Exceed specified standards	minor
Flicker	No noticeable flicker by naked eyes at any gray scale level	major
LCD Pooling	In 50% gray pattern, hold LCD panel TOP edge (PCB side) by both hands and swing slightly back and forth 2 times per second for 3 cycles by 15 degrees (Range 30 degrees)	minor

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